Single Phase Motors:

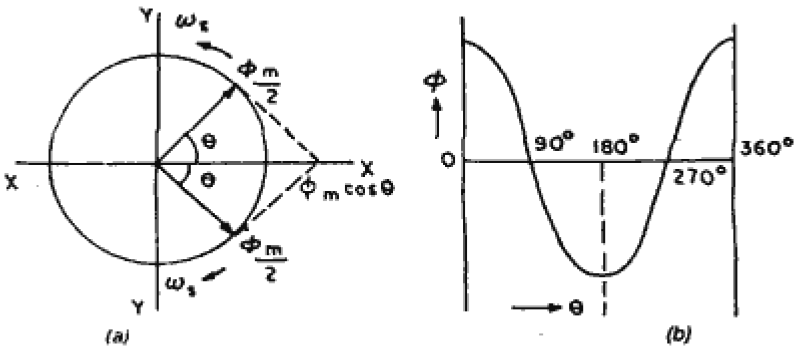
These motors perform varieties of service in the home, office, business concerns, factories and farms and in a number of other applications where single phase supply is available.

Single phase motor is not self-starting. Hence, it is provided with an extra winding known as auxiliary or starting winding in addition to main or running winding. These two windings are spaced 90° electrically apart and are put in parallel, so that a rotating field is produced.

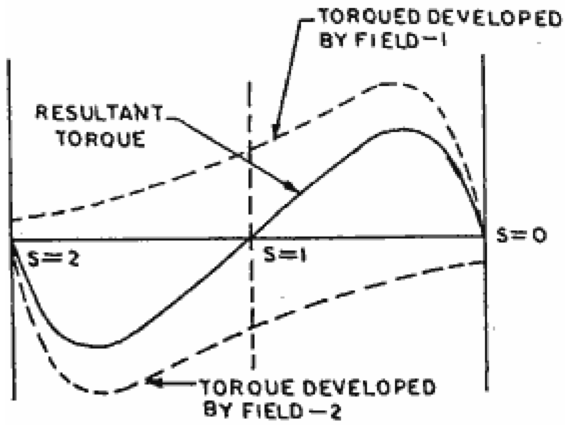
The explanation of single phase motor is made from double revolving field theory. The pulsating field produced in single phase AC motor is resolved into 2 components of half the magnitude and rotating in opposite directions at the same synchronous speed.

Let ϕ_m be the pulsating field which has two components each of magnitude $\phi_m/2$. Both are rotating at the same angular speed ω_r rad/sec but in opposite direction as shown in the Figure given below.

The resultant of the two fields is $\phi_m \cos\theta$. Thus the resultant field varies according to cosine of the angle θ. The wave shape of the resultant field is shown in Figure given below.



Thus an alternating field can be represented by the fields each of half the magnitude rotating at same angular speed of ω_s radians/sec but in opposite direction. The two revolving fields will produce torques in opposite directions. Let the two revolving fields be field No. 1 and field No. 2. Let the field No. 1 rotate in the clockwise direction and field 2 rotate in anticlockwise direction. Clockwise torque is plotted as positive and anticlockwise as negative. At stand still, slip for both fields is one. Synchronous speed in clockwise direction will give condition of zero slip for field 1 but it will give slip = 2 for field No. 2. Similarly synchronous speed in a counter clockwise direction will give condition of zero slip for field 2 but slip = 2 for field No. 1. Now in the two curves produced by the two revolving fields have been drawn and the resultant i.e., algebraic sum of the two fields will give the net developed torque or resultant torque. Now if we look at the resultant torque we see that the starting torque (torque at slip = 1) is zero. And except at starting there is always some magnitude of resultant torque, which shows if this type of motor once started, in any direction it will develop torque and will function as motor. Hence single phase motor with single winding develops no starting torque but if the machine is started in any direction by some auxiliary means, it will develop torque in the same direction in which it is started.



Three Phase AC Motor

Motors have been described as a transformer with a rotating secondary. Motors, generators, and

transformers are similar in that their basic principle of operation involves induction. The premise

for motor operation is that if you can create a rotating magnetic field in the stator of the motor, it

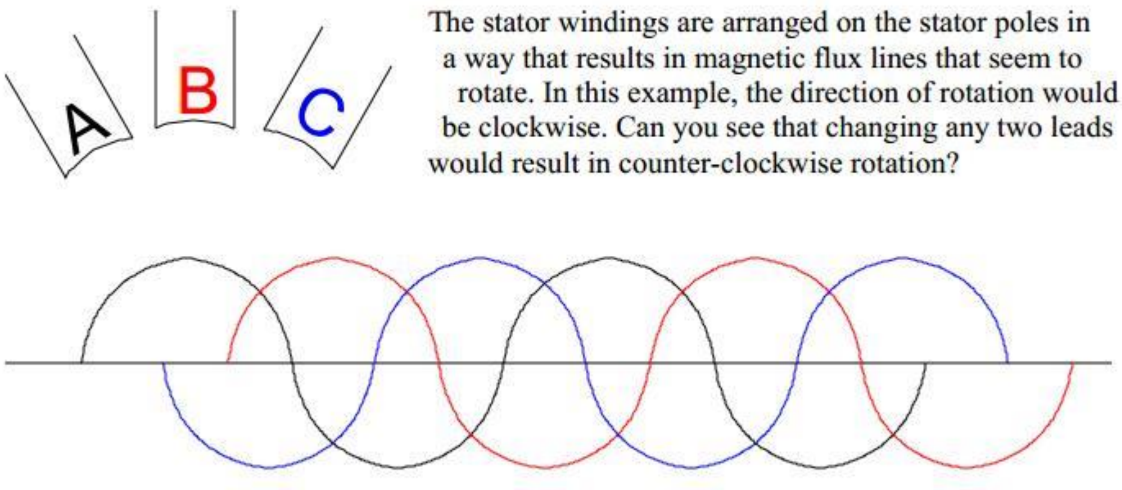
will induce a voltage in the armature that will have magnetic properties causing it to 'chase' the

field in the stator. This premise applies to AC motors that employ a squirrel cage rotor, and it is

probably the most simple and basic of all motor designs. The three phase motor is widely used in

industry because of it's low maintenance characteristics. Due to the nature of three phase power,

creating a rotating magnetic field in the stator of this motor is simple and straight forward.



The strength of the magnetic field changes, as the current flow in the coils of wire around the stator poles change. Just as the current in the field windings rise and fall 120 electrical degrees apart, so does the resulting magnetic field on the pole face. In other words, when the magnetic polarity on pole 'A' reaches it's peak, 120 electrical degrees later pole 'B' will reach it's peak, and

120 electrical degrees after that, pole 'C' will reach it's peak. Then the cycle repeats itself, and a rotating magnetic field is developed in the stator of the motor.